The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. XLVIII
NO. 1240

SATURDAY, APRIL 3, 1943
REGISTERED AS A NEWSPAPER

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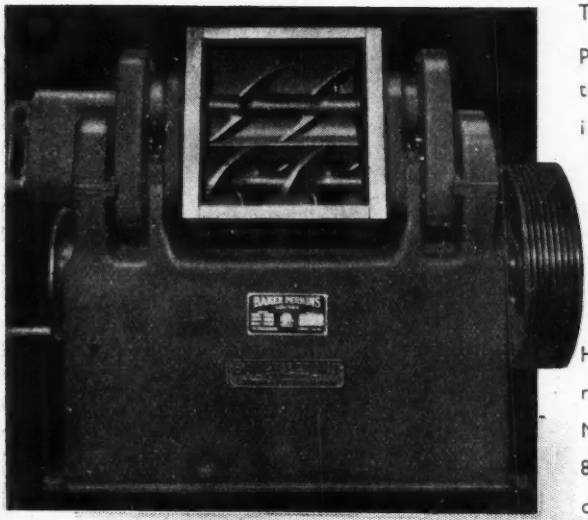

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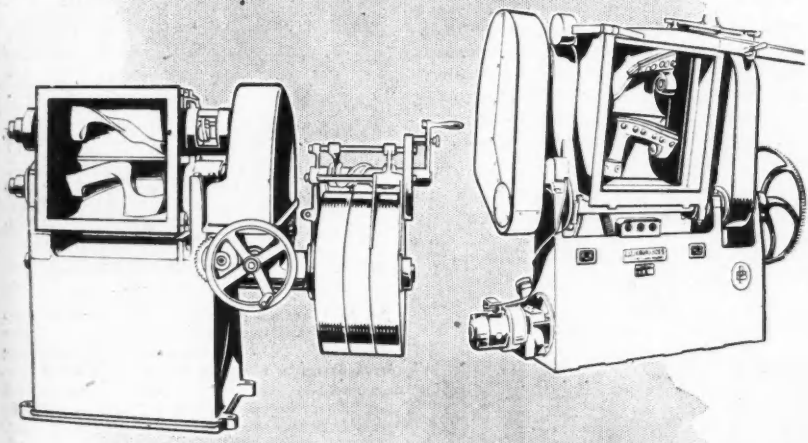

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The Chemical Age

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THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers Limited.

VOL. XLVIII
No. 1240

April 3, 1943

Annual Subscription 21s.
Overseas 26s.

Scientific Freedoms

ON a previous occasion the subject of the freedom of scientific men to work in the manner which they felt best disposed to do was discussed in these columns. Accordingly, we were interested to hear an address on this subject by Dr. Baker, of Oxford University, before the Institute of Physics at its annual general meeting. Dr. Baker's address was frankly semi-political. It appears that the scientific world, and by this we mean the academic world of science, is greatly concerned just now about the direction that scientific work shall take. Following a recent meeting of the British Association, this body laid down certain fundamentals which go far in the direction of planned scientific research such as has been practised in totalitarian countries. We should perhaps say rather, such as is *believed by many* to have been practised in totalitarian countries, for one speaker, who had worked in Russia for some years, strenuously denied that there was any regimentation of scientists in that country and maintained that there is still complete academic freedom there, and always has been.

There are many academic scientists, among whom Dr. Baker appears to be a leader, who vigorously denounce any idea of planned scientific research, and echoes of this controversy have been found in the columns of THE CHEMICAL AGE. Dr. Baker's group demands four freedoms for the scientist: (1) freedom of speech; (2) freedom to work; (3) freedom of inquiry; and (4) freedom to establish oneself as a research worker. Two of these are important enough to be discussed here. The first is freedom of inquiry. Here the group concerned is stoutly opposed to any planning of scientific investigation and believes that every research worker should be at liberty to switch over his investigations at any time to any subject which he believes he should investigate. Dr. Baker's argument for this is that only thus could many of the greatest discoveries of the age have been made. All chemists know well the part that chance plays in chemical discovery. Chance, however, comes only to those who are able to take advantage of it. It has been said by a well-known scientist that "accidents only happen to those who deserve them." This is akin to Pasteur's remark that chance only favours the prepared mind. Thus it happens that some of the most remarkable medical

On Other Pages

discoveries of our generation could only have been made if those who had observed chance happenings had had full freedom to pursue their observations in a direction very different from that of their intended researches. We do not think that anyone would seriously attempt to controvert Dr. Baker's thesis on this point, but from it arises the very interesting point as to how far freedom of research can be applied to industry.

In an industrial research organisation scientific men are employed and paid to carry out investigations likely to benefit their own industry, and not to engage in fields of activity that may be of considerable use to humanity, but have no particular value to their employers. It is here that the Director of Research of the organisation must have vision and imagination. If an unforeseen observation suggests to those who make it that it is worth following up, it is for the Director to decide whether it should be followed by his organisation or elsewhere. Dr. Baker made it clear that he did not apply his "freedom of inquiry" to industrial research organisations, but only to the academic field.

The difficulty that arises is to keep the industrial organisation on sound commercial lines while not neglecting any opportunity to add to the sum of human knowledge in other fields. The solution of the difficulty would appear to be a close liaison between the industrial organisation and the academic worker so that chance observations of possible importance should be brought to the notice of those who can investigate them further. There should be some machinery for doing this other than the bare publication of papers in scientific journals, because it is not clear otherwise how far academic workers will be welcomed in a field which is apparently being explored by someone else. This is not a matter that can be taken up by any particular body connected with one science; it seems to be rather a matter for the Royal Society or the British Association, since an observation in one branch of science may be of profound value to those who are engaged in other branches, and who may wish to investigate it in directions other than those visualised by the original inquirer.

Dr. Baker's fourth freedom, the freedom to establish oneself as a research worker, is more difficult. He pointed out that a surprisingly large number of the most eminent scientists in the world were the sons of parents in very poor circumstances who yet managed to become established in their profession. If they had not been able to become established the discoveries which they made would have been lost to the world. One has only to mention the name of Faraday to realise how important this freedom may become. The fundamental difficulty is that the normal mechanism, that of scholarships, is not sound because scholarships favour the precocious, and scientists, as Dr. Baker observed, are not precocious. The scientist is frequently not specially distinguished at school and therefore does not win scholarships. It is in later years that his particular aptitude appears to develop. We do not propose to follow this interesting subject farther beyond pointing out that the value of a scientist depends upon the work he can do and not upon the eminence of the Institutions from which he has received his education, nor upon the collection of degrees and diplomas he has gathered.

Britain, in Dr. Baker's view, was falling to a poor fourth place in the scientific world before the war. Germany, Russia, and above all the U.S.A. were making very much greater use of the work of scientific men. One of the more interesting suggestions made to overcome this difficulty is that there shall be greater interchangeability between pure scientists and their industrial brethren. The pure scientist should spend a year now and again in an industrial laboratory; likewise the industrialist should take his place on the staff of a university under such conditions that he can take his full share in the life of that institution. In this way it should be possible to keep pure science and technical science in step. The idea is not by any means new, and it is becoming increasingly recognised that pure scientists should be brought more into contact with practical affairs than they are to-day in order to broaden their outlook, and at the same time that industrial scientists stand in need of a periodical spell of quiet during which they can absorb new ideas and bring their knowledge of scientific developments up to date.

NOTES AND COMMENTS

The War Against Waste

A SHREWD blow in the campaign against waste was struck by Sir James Marchant in his lecture delivered at the Union Society's Hall, Oxford, and entitled "World Waste and the Atlantic Charter"; and Mr. Basil Blackwell has done important service in publishing the lecture in pamphlet form at the modest price of one shilling. Sir James personifies the great God Waste as a devouring monster into whose jaws man has thrown treasure beyond the dreams of avarice and human lives beyond reckoning. Conservation of resources has therefore become an urgent problem, and closely linked with this is the question of the use and ultimate end of metals in circulation and their imperative recovery as scrap, and its corollary, the discovery and sorting of industrial scrap. It is appropriate that from the United States, the scene in past decades of the most reckless profusion of waste, should have come the first systematic classification of scrap (outlined in our metallurgical section in this issue), though that only deals with the recovery of waste metal.

Economy and Salvage

IT must be remembered, as Sir James Marchant pointed out, that there are two stages in the fight against waste; first, economy, and second, salvage. Economy, or prevention of waste, should be divided into economy in use and economy of manufacture, while salvage comprises both a planned policy and the discovery and collection of available materials. Rubber, oil, bones, blood, paper, rags, and kitchen waste—all are vital not only for the war effort but for the future. The systems of collection and recovery of scrap that have been perfected under the impulse of war-time necessity must not be allowed to lapse because of the inevitable urge towards relaxation that is bound to overtake us at the end of the war. In other words, if we are really to recover from the war, salvage must not die at the first news of peace. A perusal of Sir James Marchant's lecture in full gives a vivid picture of our past sins, together with sound advice on how we may rebuild the edifice shattered by human folly.

A Technical House

OPPORTUNITIES for intercourse R. E. Slade, M.C., described to technical bodies, except perhaps in London, are not sufficiently numerous, especially now that the British Association has, for obvious reasons, been obliged to discontinue its regular annual meetings. A method of remedying this was suggested last week by Mr. T. H. Gant, chairman of the Midland Section of the Institute of Chemistry, at the annual meeting in Birmingham. Basing his suggestion on the fact that municipal reconstruction schemes will be essential in most of the great technological centres of Britain, he boldly advocated the erection of a "Technical House," capable of accommodating all the technical bodies in Birmingham, and fitted, of course, with convenient lecture rooms, theatres, library, etc. He further announced that the leaders of the industries involved, as well as the three official chemical bodies, were prepared to lend their support. Surely, it is not too much to hope that the great cities of this kingdom will not find it "uneconomic" to lay aside the relatively small sum of money necessary to provide such an amenity for the technical men, on whose efforts, when all is said and done, their prosperity rests. Chemists may be well pleased that the idea emanated from a member of their profession.

Chemical Pest Control

CHEMICAL pest control, which Dr. R. E. Slade, M.C., described to the Royal Society of Arts last Wednesday, as an integral part of the food production, food storage, and transport industries, is, in its present form, the outcome of long and laborious researches. The list of pests that have to be controlled ranges from leopards, through rats and rabbits, weeds and insects, to microscopical fungi; and through almost the whole of this scale the chemist plays an important, probably the most important part. Few chemists, probably, are aware that the standard method for disposing of leopards which have shown a predilection for battening on domestic animals, is to bait a piece of meat with a thin

glass bulb containing anhydrous prussic acid. More of us, however, are familiar with the "Cymag" process, by which the rabbit population of this country has been brought to its lowest level since the days of the Romans. Still more are interested in the various methods by which the chemist has sought to remedy the fluctuating supply and irregular performance of "natural" insecticides, through the introduction of factory products of standard quality. The various and fascinating series of problems that have been presented to the pest-controlling chemist and his colleague in the biology department were detailed by Dr. Slade in a sort of general panorama; and he outlined many problems that still resist the combined efforts of scientific workers, *e.g.*, the control of deep-rooted perennial weeds; the discovery of chemicals of selective toxicity; and the best methods of using known fungicides with maximum efficiency.

A Lead from Yale

THE appointment of a university professor to an important research position in the American aircraft industry is announced in our "personal" column this week. What makes it more interesting is that the professor happens to be a chemical engineer. This is just one more piece of evidence to reinforce our contention that the United States' system of linking up the academic and the industrial sides of research is a long way ahead of our present method of almost watertight compartments. Yet there is nothing really revolutionary in the idea; professors of economics abound in official and industrial positions in this country, and we feel sure that even the most convinced opponent of merging the academic and the industrial planes of research would be prepared to admit that the academic economist is quite as "theoretical" as the university scientist. We foresee that the objection may be raised that most American universities partake much more of the nature of technical colleges than do ours. But the university in question is not a small "provincial" college; it is none other than the distinguished and ancient foundation of Yale, which can hardly be described as a technical college. Let us hope that this American straw is really an indication of the way the wind is blowing. University students of chemical engineering will then no longer need to fear that they are walking up a blind alley, but can hope that constructive positions in industry may be opened to them, even if they dare to tread the path of academic distinction.

The Future of Export

AT a luncheon in London on Monday, Mr. Leslie Gamage, in accepting the presidency of the Institute of Export, said that in looking back over the last few years he was struck by the extraordinary variations which had taken place in the attitude of the Government, and in public opinion generally, towards the export industry. Under the conditions created by Lease-Lend, he said, one tended to feel that one was committing a crime in endeavouring to keep our export trade going, but public sentiment had changed, and it was now realised that when the war was over, export would be a first priority. One will readily agree with Mr. Gamage in his suggestion that, failing greatly increased exports, all our hopes of social security are merely idle dreams, impossible of fulfilment, because without the wherewithal any talk of better health, housing, and education is practically useless. It is realised by most people that difficulties facing export will be greater after the war, for as Mr. Gamage put it, "other countries will have the same objectives as we, so that unless something is done there will ensue a mad scramble for exports." Being a practical man, Mr. Gamage declares that our only hope is to proceed by way of international agreements among manufacturers and producers, which will regulate prices, particularly of food and raw materials, and the distribution of manufactured products, and also co-ordinate the whole field of air transport. He says that such agreements must entail some measure of Government control, and that industry will need a greater measure of Government assistance. This opinion will no doubt meet with general approval, but industry itself must be alive to its needs, otherwise it will get the sort of conditions it deserves in the post-war world.

Boiler-Water Treatment—I

Old Methods Modified : New Methods Developed

by D. D. HOWAT, B.Sc., Ph.D., F.I.C., A.M.I.Chem.E.

PURE water, the virtues of which are praised so highly by a small minority of the community, is almost a myth as any chemist knows, frequently to his sorrow. One of the commonest solvents, easily the most plentiful, and in many respects the most general, cannot be expected to occur naturally in a pure state. The impurities existing in water from almost every natural source may be gross particles of solid, such as fine gravel, colloids like certain of the highly aluminous clays, numerous salts in solution with varying quantities of oxygen, nitrogen, carbon dioxide, and not infrequently hydrocarbons. For the research chemist in the laboratory these substances present obstacles to the observation of certain delicate tests and may interfere with reactions. To the housewife, there are the problems of obtaining easy lathers and of deposits in boilers and kettles. The chemical engineer is troubled about many things, precipitation in the filter beds, deposits in pipe lines, scales in boilers, economisers, and preheaters.

Urgency of Scale Problems

With the advent of the modern boiler and highly superheated steam the problems of water treatment have steadily increased both in volume and importance. Scale, 0.05 inches thick, in high-pressure boiler tubes may lead to serious damage both to plant and personnel by tube failures. The presence of even thinner layers of scale gives a rapid drop in heating efficiency with a corresponding increase in the fuel bill. The stress of war conditions, with serious reduction in fuel allowances, has made the problem even more pressing.

Solid impurities, even when colloidal in nature, do not present any serious chemical problem, their removal being affected by sedimentation, coupled with coagulation where necessary, and followed by filtration. Soluble salts may be divided into two categories, those causing temporary hardness, and those giving rise to permanent hardness. When natural waters are saturated with carbon dioxide the calcium and magnesium exist mainly as soluble bicarbonates which are easily decomposed on boiling, precipitating the insoluble normal carbonates. These insoluble carbonates form soft deposits in economisers, heaters, cooling jackets, etc., but not a closely adherent scale with high resistance to heat transference. The salts causing permanent hardness present a more complex problem. Calcium sulphate, the most common source of permanent hardness, is much more soluble in water than the carbonates. The formation of a sulphate scale arises over a period of time, the salt becoming more concentrated until the solution becomes saturated, when precipitation takes place with the formation of a series of superincumbent layers. These sulphate scales are hard and closely adherent with very high resistance to heat transfer. Soluble silica frequently occurs in natural waters and, if not removed, is liable to combine with calcium and magnesium to form hard silicate scales. The presence of a layer of silicate scale only 0.05 inches thick may be the cause of a serious tube burst. The carbon dioxide and oxygen present in natural waters are not infrequently the source of grave corrosion troubles. Carbon dioxide contaminating the steam will aggravate corrosion of turbine blades. In high-pressure boilers absolute elimination of oxygen is essential to prevent corrosion of tubes, superheater and turbine blades.

Softening Processes

In modern chemical terminology, "water softening" is often used to cover not only true softening (*i.e.*, removing the calcium and magnesium salts), but also the removal of all substances which may cause the formation of scale in boilers. The principal processes may be divided roughly into three main classes:

1. Those which remove the calcium and magnesium cations by precipitation —the commonest method of this type being the lime-soda process.

2. Those which replace the calcium and magnesium cations by some cation such as sodium, which does not give insoluble salts. Of the methods included

under this heading are the base exchangers, *e.g.*, zeolites, greensands, treated coals, and resins.

3. Those which remove both the cations and anions to produce water containing little or no dissolved solids. The only substances capable of fulfilling these conditions are the cation and anion exchange synthetic resins.

Some account will be given of the recent advances in technology and research on the different processes mentioned, together with a discussion of the problem of silica removal, the elimination of troublesome gases, and the conditioning of boiler water.

Lime-Soda Process

The basis of the lime-soda process of water-softening is the precipitation of calcium and magnesium in the form of insoluble compounds from the salts originally present in the water. Thereafter the insoluble compounds are removed by sedimentation and filtration. The chemicals required for this process, hydrated lime and sodium carbonate, are cheap and easily obtainable, facts which have contributed largely to the widespread adoption of the process. By the use of hydrated lime and sodium carbonate the calcium salts in solution in the water are precipitated as calcium carbonate and the magnesium salts as magnesium hydroxide. Both temporary and permanent hardness are removed from the water. The highly soluble calcium bicarbonate is precipitated as the much less soluble normal carbonate, the dissolved carbon dioxide also being removed by combination with the lime. Magnesium bicarbonate is converted into the hydroxide, while the sulphates of calcium and magnesium originally in solution are replaced by the equivalent amount of sodium sulphate, the calcium and magnesium being precipitated as insoluble carbonates. For the successful operation of a lime-soda plant the following gear must be incorporated.

1. An accurate apportioning apparatus for measuring the reagents and the water.

2. Means of effecting thorough mixing of reagents and water.

3. Equipment for the agitation of the suspension in which the precipitations are forming until the particles of insoluble matter have aggregated into "flocs" large enough to settle easily.

4. Settling tanks of adequate capacity and design to ensure maximum sedimentation.

5. Under certain conditions "carbonation" and filtering may be required as additional procedures.

No attempt will be made to discuss the standard types of lime-soda plant, but Fig. 1 shows a diagrammatic arrangement of a plant with variable-flow, ground control chemical proportioning apparatus. A number of disadvantages are attendant on this process:

1. Incomplete softening of the effluent water: the water is not completely softened, the residual hardness being about 2 to 3 grains per gallon.

2. Troubles have arisen with sedimentation and filtration of the insoluble calcium and magnesium carbonate formed, a minimum settling time of about four hours being necessary.

3. "After-precipitation": scale deposits of calcium carbonate sometimes occur in feed lines. This may be avoided by "carbonation" treatment with gaseous carbon dioxide, but great care must be exercised to prevent subsequent corrosion of pipes and fittings by any excess of carbon dioxide remaining in solution.

Recent Advances

The advances made in recent years in the development of the lime-soda process have aimed at obviating or at least minimising the three main disadvantages noted above.

Two American investigators, Larsen and Buswell,[1] have shown that the combined theoretical solubilities of calcium carbonate and magnesium hydroxide are equal to 20 to 25 p.p.m. (1.6 to 1.8 grains per gallon) expressed as calcium carbonate, or slightly less at the high pH values characteristic of the process. They have also recorded that the actual values obtained, considerably higher than the theoretical, may be due to the formation of a relatively stable supersaturated solution of calcium carbonate and magnesium hydroxide. The other suggestion is that the higher hardness values are caused by colloidal particles. Three methods of reducing the excess hardness values are:

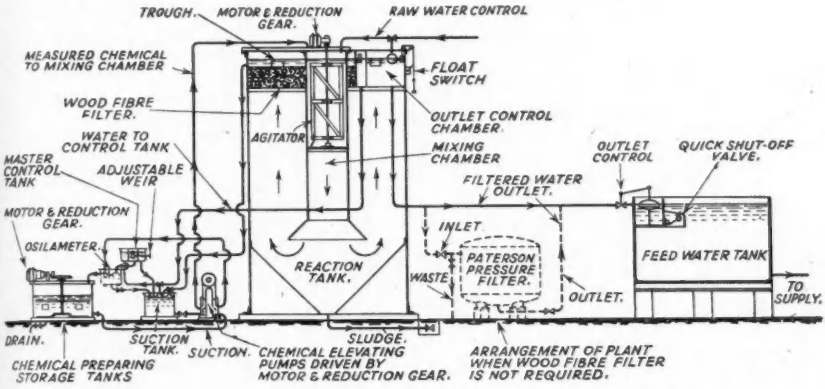
1. By carrying out the process at elevated temperatures; the rate of the reaction is approximately doubled with each 10° C. rise in temperature.

2. By adding coagulants to the pro-

cess: aluminium and sodium aluminate have been most successful in commercial practice.

3. By prolonging the sedimentation time. This last method is the least attractive commercially, and many of the recent improvements have aimed primarily at reducing the sedimentation area required and shortening the usual 4 to 6-hour period.

Hot softening is only generally acceptable for boiler-feed water treatment and not as a general softening. It is usually most feasible where a surplus of exhaust steam is available.



[By courtesy of Paterson Engineering Co., Ltd.

Fig. 1. Diagram of Paterson water-treatment plant, with variable-flow ground-control chemical proportioning apparatus. A normal type of lime-soda softener with a wood-fibre filter and an alternative arrangement of a pressure filter.

The following advantages may be noted: 1. A softer water is obtained.

2. The softened water contains a slight lower degree of soda alkalinity.

3. Sedimentation takes place more rapidly and, except for boilers operating at pressures over 150 lb./sq. in., filtration

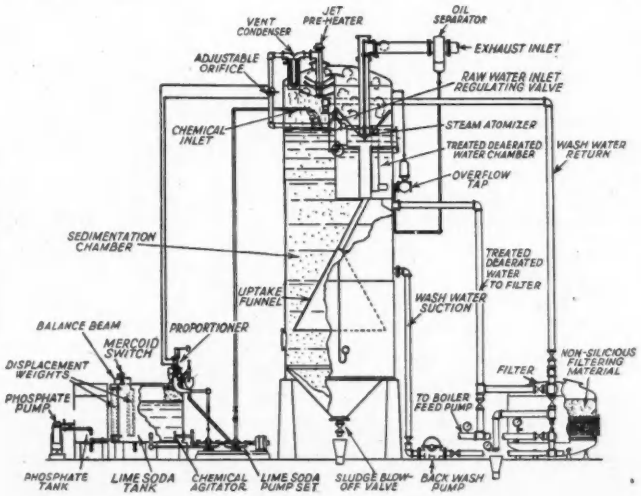


Fig. 2. Cochrane hot-process softener, using lime and soda as reagents, with a supplementary feed of phosphate to the boilers (Behrman and Gustafson).

of the softened water through a bed of wood wool gives sufficient clarity.

4. A certain degree of de-aeration takes place, usually sufficient for practical purposes unless in very high pressure installations.

5. Where economisers are installed the flow of hot softened water prevents sweating on the lower rows of economiser tubes.

Fig. 2 shows a line drawing of an American Cochrane softener in which the reactions take place at a steam temperature corresponding to about 5 lb./sq. in. gauge pressure. A de-aerator is included in the apparatus, the hot softened water rising up through a conical funnel into the de-aeration chamber where the oxygen is scoured from the water by low-pressure steam escaping from an atomiser. The treated de-aerated water is filtered through a pressure filter containing non-siliceous material.[2]

The Use of Coagulants

From experimental work on coagulants, sodium aluminate appears to have proved most satisfactory. Under the conditions obtaining in the lime-soda process this reagent hydrolyses to caustic soda and aluminium hydroxide, the latter occurring in the form of very minute flocs bearing a negative charge. Aggregation of the negatively charged aluminium hydroxide flocs with the positively charged magnesium hydroxide flocs takes place readily, the aggregates settling rapidly and carrying down mechanically entrapped particles of other solids present. Conclusive tests have shown that the use of sodium aluminate offers the following advantages:

1. The time of sedimentation is considerably shortened. From a given plant a 25 per cent. increase in throughput may be obtained.

2. The residual hardness is diminished. With ½ gr. of reagent per gallon, hardness may be reduced by 17 to 34 p.p.m. = 1 to 2½ gr. per gall.

3. The quantity of silica removed is greater than with lime-soda alone.

Sedimentation and Filtration

By the development of new types of precipitators attempts have been made to improve upon the period of 4 to 6 hours required for adequate sedimentation in the lime-soda process, and features of two of these new types may be noted.

(a) *The Spaulding Precipitator* (Fig. 3). Although in this apparatus the normal mixing and coagulation period is allowed, arrangements for precipitation and sedimentation are novel. The outer part of the apparatus is an inverted truncated cone enclosing an inner normal cone open at both ends. A vertical shaft, located in the centre of the precipitator, carries a rotating paddle which maintains the sludge at the bottom in a state of slow agitation. The water mixed with the necessary chemicals is fed in at the top of the inner cone. Flowing downward through the cone the speed decreases steadily, the water percolating slowly through the agitated sludge of precipitated solids in the base. On emerging from the base of the inner cone the stream is turned upward and again, owing to the arrangement of the cones, the speed is reduced, further precipitation occurring. Clear water finally overflows at the periphery of the outer cone. The solids accumulating in the base of the outer cone are discharged at regular intervals. The outstanding features of this softener are:

1. The water is made to flow at progressively slower speeds first downward and then upward through a bed of suspended solids.

2. The precipitation of the minute particles of calcium carbonate and magnesium hydroxide takes place upon existing solid nuclei. This reduces the tendency towards the formation of colloidal

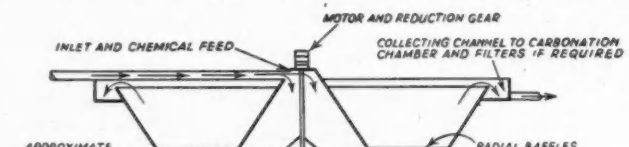


Fig. 3. Spaulding type of lime-soda softener (Applebaum).

particles of very slow settling rates and the formation of unstable super-saturated solutions.

Applebaum[3] has given an interesting report containing full data on the results obtained by modifying existing softening tanks in municipal water undertakings to conform to the Spaulding principle. His figures prove the increase in output obtained and the reduction in settling capacity rendered possible by these modifications. The following are the comparative chemical results obtained on a plain settling tank and in a similar tank converted to a Spaulding precipitator.

	Raw Water	Effluent of plain tank	Effluent of Spaulding Precipitator	Improvement per cent.
Flow rate in g.p.m. ..	—	6,000	18,000	200
CaO fed (p.p.m.)	—	118	118	—
Ferrisil fed (p.p.m.) ..	—	10	10	—
Hardness ..	186	106	92	13
Methyl orange alkalinity ..	134	49	34	30
Phenolphthalein alkalinity ..	—	30	20	—
Caustic alkalinity	—	11	6	—
Turbidity ..	142	22	13	41

Chemical results expressed as parts $CaCO_3$ per million.

(b) *The "Accelator" Water Softener* (Fig. 4). This apparatus represents a radical departure from all the previous types of lime-soda softeners. A vertical shaft, driven by an electric motor and equipped with two propellers, is set in the middle of the main tank. Placed about the middle of this shaft and surrounding the upper and smaller of the two propellers is a small cylinder set on top of a truncated cone reaching almost to the bottom of the tank. A larger-diameter cylinder surrounds the smaller one, extending above and below it. A narrow annular opening exists between the base of this outer cylinder and the outside wall of the truncated conical extension of the small cylinder. A large impeller fixed to the bottom of the vertical shaft keeps in slow agitation a pool of slurry, this slurry filling the main tank to about one-third of the total depth. Raw water is fed from a pipe discharging at the base of the conical extension near the bottom of the slurry pool. A concentrated suspension of the lime-soda chemicals is also added at the same level. In this space, underneath the conical extension, described as the primary mixing and reaction zone, the first vigorous interaction between the raw water and the added chemicals takes place. The slurry, consisting of a large percentage of solids previously employed for precipitation, offers a large number of nuclei on which the freshly precipitated carbonate and hydroxide may crystallise. The stream rising through the slurry pool into the interior of the small cylinder undergoes further mixing in the secondary mixing zone through the action of the small impeller. Overflowing the top of the small cylinder, the water emerges into the secondary reaction zone between the outer and inner cylinders. The downward flow of water then enters the slurry pool, passing through the narrow annular space already mentioned. Final separation of solids occurs here, the clear water rising upward through the pool and discharging into an annular launder located near the top of the secondary reaction chamber. The clear softened water is finally discharged either to carbonisation chambers or filters. Steady discharges of slurry take place from a small chamber built on to one side of the apparatus, the height of the chamber regulating the depth of the slurry pool. Material flows over the top of the chamber, settles at the base and is discharged continuously

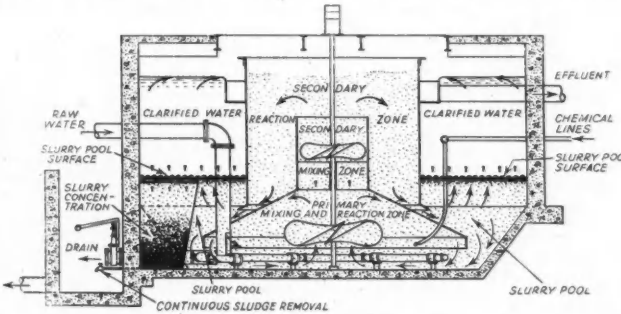


Fig. 4. Cross section of typical "Accelator" water softener (Behrman and Green).

through a regulating valve. The important features of this plant are:

1. Precipitation of carbonate and hydroxide takes place in the slurry pool on preformed nuclei. This diminishes the tendency to form colloidal particles and forms a heavy flocculent sludge.

2. The sludge is more efficiently used, consumption of reagent is reduced, and the tendency to "after-precipitation" is minimised.

3. Impeller speeds and the rate of raw water feed are so regulated that one volume of feed water and four volumes of slurry are circulated at relatively high speeds through the mixing and reaction zone. Essentially, this means that the feed water is circulated five times through the reaction zone before discharge.

4. The impeller produces a suction sufficiently great to keep the slurry near the bottom of the tank, allowing rapid separation of clear water from the slurry pool.

5. The turbidity of the effluent is reduced to less than one grain per gallon.

The rate of discharge from this type of softener is claimed to be three gallons per minute per sq. ft. of slurry pool surface.[4]

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[1] LARSEN and BUSWELL, *Ind. Eng. Chem.*, 1940, **32**, 130.
[2] LARSEN and BUSWELL, *ibid.*, 132.
[3] APPLEBAUM, *Ind. Eng. Chem.*, 1940, **33**, 678.
[4] BEHRMAN and GREEN, *Ind. Eng. Chem.*, 1939, **31**, 128.

(*To be continued*)

Personal Notes

PROFESSOR CLIFFORD COOK FURNAS, associate professor of chemical engineering at Yale University, has been appointed director of research for the aircraft division of the Curtiss-Wright Corporation, Buffalo, New York.

MR. ROBERT L. TAYLOR, who has been a divisional advertising manager of the Monsanto Chemical Company, and associate editor of *Chemical and Metallurgical Engineering*, has been appointed to succeed Mr. W. J. Murphy as editor of *Chemical Industries*.

Obituary

MR. ROBERT BRUCE MASON, director of Mason Brothers (Smelters), Ltd., has died at Dewsbury, aged 49.

CAPTAIN JOHN FYFE, M.C., of Mathews, Maclay and Manson, Ltd., paint manufacturers, died in Glasgow on March 27.

SIR MAX JULIUS BONN, chairman, among other concerns, of United Bottle Manufacturers, Ltd., died in London on March 25, aged 65.

MR. HERBERT MARSDEN, B.Sc., A.I.C., from 1915 to 1939 chief chemist with Genatosan, Ltd., and previously with Fison's, Ltd. (then Fison, Packard and Prentice), died at his home at Lockington, near Derby, on March 23, aged 60.

MR. FREDERICK WILLIAM JACKSON, F.C.S., A.I.C., chemist with Marsh and Baxter, Ltd., for ten years, died at Chipping Campden on March 22, aged 52. During the last war Mr. Jackson was in the Ministry of Munitions, and since then has held positions with Huntley and Palmers, and Holbrooks of Birmingham.

DR. W. LEE LEWIS, the well-known American chemist, has died at his home in Evanston, U.S.A. Lewis was noted among chemists for his research work in the field of organic arsenicals and of sugars; to the outside world his name was familiarised by the war gas "Lewisite"—2-chlorovinyldichlorarsine—which he perfected shortly before the end of the last war.

New Control Orders

Iron and Steel Scrap

The Minister of Supply has issued the Control of Iron and Steel (No. 30) (Scrap) Order, 1943 (S. R. & O. 1943, No. 435, price 5d.), which came into force on March 29, superseding all previous Scrap Iron and Steel Orders. The Order has been issued principally for the purpose of combining in one document the provisons of the Nos. 14, 21, 24, 25, 27 and 29 Scrap Orders, although the opportunity has been taken of effecting a number of alterations in wording for the sake of consistency in both the body of the Order and the specifications set out in the price schedules.

Fertiliser chemists of the U.S. Bureau of Agriculture are already investigating methods of combining larger quantities of nitrogen with other fertiliser elements, in anticipation of the increased output of nitrogen after the war from factories now manufacturing synthetic nitrogen for explosives and other munitions of war.

The Federal Government of Brazil will purchase at minimum prices all the industrial alcohol produced in the country during the next five years. The Institute of Sugar and Alcohol will control all alcohol, including amyl alcohol, produced. Similarly, the Federal Government will purchase at minimum prices all petrol and diesel oil produced in Brazil within the same period.

Metallurgical Section

Published the first Saturday in the month

Metallurgical Section

April 3, 1943

The Cycle of Non-Ferrous Metals—II

Classification of Scrap

by O. EINERL, Dr.Eng., and F. NEURATH, Ph.D.

AS the conservation and utilisation of waste is an economic necessity in war time, this survey has been made to assist the general knowledge of this important subject and to rectify prejudiced opinions regarding secondary alloys made from scrap. To our knowledge, however, no generally agreed commercial rules for scrap metals and their alloys and residues exist in Great Britain comparable with those published in the United States, Germany, and elsewhere. The Standard Classification for Old Metals, effective from June 1, 1940, and published by the National Association of Waste Material Dealers, Inc. in New York may therefore, be of interest.

Copper and Brass

No. 1 Copper Wire: Clean untinned copper wire not smaller than No. 16 B. & S. Wire gauge; free from burnt copper wire, which is brittle, and all foreign substances. *No. 2 Copper Wire*: Miscellaneous clean copper wire which may contain a percentage of tinned wire and soldered ends, but must be free of hair wire and burnt wire which is brittle; the tinned wire not to be over 15 per cent. of the total weight. *No. 1 Heavy Copper*: Untinned copper not less than 1/16 inch thick; may include trolley wire, heavy field wire, heavy armature wire, which is not tangled, and also new untinned and clean copper clippings and punchings, and clean copper segments. *Mixed Heavy Copper*: Tinned and untinned copper, consisting of copper clippings, clean copper pipe and tubing, copper wire free of hair wire, and burnt and brittle wire free from nickel-plated material. *Light Copper*: Bottoms of kettles and boilers, bath-tub linings, hair wire, brittle burnt copper wire and roofing copper, free from brass, lead, and solder connections, readily removable iron and old electrotype shells, and free from excessive paint, tar, and scale. *Composition or Red Brass*: Red scrap brass, valves, machinery bearings and other parts of machinery, including miscellaneous castings made of copper, tin, zinc and lead, no piece to measure more than 12 inches over any one part or to weigh over 60 lb., to be free of excessively leaded material, cocks and faucets, gates, pot-pieces, ingots and burnt brass, aluminium composition, manganese, and iron. *Railroad Bearing*: Railroad boxes or car journal bearings; must be old standard used scrap, free of yellow boxes and babbitt, and of excessive grease and dirt. *Cocks and Faucets*: Mixed clean red and yellow brass, free of gas cocks and beer faucets, and to contain a minimum of 35 per cent. red brass. *Heavy Yellow Brass*: Heavy brass castings, rolled brass, rod brass ends, chandelier brass tubing, not to contain over 15 per cent. of tinned or nickel-plated material; no piece to measure more than 12 inches over any one part; must be in pieces not too large for crucibles and must be free of manganese mixture, condenser tubes, iron, dirt and excessively corroded tubing; also free of aluminium brass containing over 0.2 per cent. aluminium. *Yellow Brass Castings*: Brass castings in crucible shape, that is, no piece to measure more than 12 inches in any direction; must be free of manganese mixtures, tinned and nickel-plated material, and visible aluminium brass. *Light Brass*: Miscellaneous brass, tinned or nickel plated, that is too light for heavy brass, free of shell cases containing paper, ashes, or iron; loaded lamp bases, clock mechanism, and automobile gaskets; must be free of visible iron unless otherwise specified. *Old Rolled Brass*: Old pieces of sheet brass and pipe free from solder, tinned and nickel-plated material, iron, paint and corro-

sion; ship sheathing, rod brass, condenser tubes and Muntz metal material. *New Brass Clippings*: Cuttings of new sheet brass absolutely clean and free from any foreign substances and not to contain more than 10 per cent. of clean brass punchings not less than one quarter inch in diameter. *Brass Pipe*: Brass pipe, free of nickel-plated, tinned, soldered pipes, or pipes with cast brass connections; to be sound, clean, and free of sediment and condenser tubes. *No. 1 Red Composition Turnings*: Free of rolling-stock box turnings and similarly excessively leaded material, aluminium, manganese and yellow brass turnings; not to contain more than 2 per cent. of free iron; free of grindings and foreign materials, especially babbitt. Turnings not according to this specification to be sold subject to sample. *No. 1 Yellow Rod Brass Turnings*: Rod turnings, free of aluminium, manganese, composition, and Tobin and Muntz metal turnings; not to contain over 3 per cent. free iron, oil or other moisture; to be free of grindings and babbitt; to contain not more than 0.30 per cent. tin and not more than 0.15 per cent. combined iron. *No. 1 Yellow Brass Turnings*: Yellow brass turnings, free of aluminium, manganese, and composition turnings; not to contain more than 3 per cent. of free iron, oil or other moisture; to be free of grindings and babbitt. To avoid dispute, to be sold subject to sample. *Auto Radiators (Unsweated)*: Subject to deduction of actual iron. The tonnage specification should cover the gross weight of the radiators, unless otherwise specified.

Zinc, Tin, and Lead

No. 1 Pewter: Tableware and soda fountain boxes, but in any case must assay 84 per cent. tin. Syphon tops to be treated for separately. *Zinc* must consist of clean sheet and cast zinc, also cast batteries free of loose oxide and dross, salammoniac containers and other foreign material. *Zinc Dross* must be unsweated in slabs and must contain a minimum of 92 per cent. of zinc. *Tin Foil*: Pure foil free of lead compositions and other foreign ingredients. *Mixed Common Babbitt* shall consist of lead base bearing metal containing not less than 8 per cent. tin, free from Allen's metal, ornamental, antimonial, and type metal. *High Tin Base Babbitt* to contain a minimum of 78 per cent. tin. *Block Tin*: Tin pipe and soda tank lining, free from solder and brass connections, pewter, pump-strips and pot-pieces. *Electrotype Shells* must be hand picked and free of loose dross and chunks of dross. *Scrap Lead* should be clean, soft scrap lead. *Battery Lead Plates*: (a) Dry battery lead plates, moisture not to exceed 1 per cent.; allowance to be made for wood, rubber, paper and excess moisture; or (b) Lead plus antimony, dry basis, less a treatment charge. *Note*: Contracts covering this item should specify which method is to be used as a basis of settlement.

Aluminium

New Pure Aluminium Clippings: New, clean, unalloyed sheet clippings or cuttings. Must be free from oil, grease, and any other foreign substance. Also to be free from punchings less than ½ in. square. *New Pure Aluminium Wire and Cable*: New, clean, dry, unalloyed aluminium wire or cable, free from iron, insulation, and any other foreign substance. *Old Pure Aluminium Wire and Cable*: Old, unalloyed aluminium wire or cable containing not over 1 per cent. free oxide or dirt, and free from iron, insulation and any other foreign substance. *Alloy Sheet Aluminium* to be sold on specification and sample. *Scrap Sheet and Sheet Utensil Aluminium*: Clean, old, unalloyed sheet and utensils and unalloyed manufactured sheet aluminium, free from iron, dirt, or any other foreign substance, and from hub caps, radiator shells, aeroplane sheet, foil, and bottle caps. *Aluminium Crank Cases*: Automobile or aeroplane crank cases, transmission cases and oil pans, free of iron, brass, babbitt or brass bushings, and any other foreign material. Oil and grease not to exceed 2 per cent. *Aluminium Cylinder Heads*: All types of aluminium automobile cylinder heads, free of iron, brass and any other foreign material. Oil and grease not to exceed 2 per cent. *Aluminium Borings and Turnings*, to avoid dispute, should be sold subject to sample. *Aluminium Foil*: Pure aluminium foil, free from paper and any foreign ingredients. *Aluminium Die Castings*: Auto steering wheels, brake shoes, and all castings made by the die-casting or pressure-casting process, free of iron, brass and any other foreign materials. Oil and grease must

not exceed 2 per cent. *Aluminium Pistons*: (a) Clean aluminium pistons shall be free from struts, bushings, shafts, iron rings, and any other foreign material. Oil and grease shall not exceed 2 per cent. (b) Aluminium pistons with struts must be free from bushings, shafts, iron rings, and any other foreign materials. Oil and grease not exceeding 2 per cent. *Aluminium Industrial Castings*: All other aluminium castings except cylinder heads, die cast aluminium, pattern metal and hat blocks, must be free of iron, babbitt, brass and all other foreign material. Casting shall not have over 4 per cent. zinc content. Oil and grease shall not exceed 2 per cent.

Nickel and Nickel Alloys

Nickel Clippings: New nickel clips, plate, and skeleton material. Minimum nickel content 98.5 per cent. Maximum copper content 0.5 per cent. *New Nickel*: Forgings, flashings, punchings, new pipe tubes, new bright wire, screen, bar, rod, angles, or other structural rolled stock. Each grade to be packed and sold separately. Minimum nickel content 98.5 per cent. Maximum copper content 0.5 per cent. *Carbonised Nickel* packed and sold separately. Minimum nickel content 95 per cent. Maximum copper content 0.5 per cent. *Old Nickel Scrap* shall be of 98-99 per cent. purity, maximum 0.5 per cent. copper. All rolled stock should come under this classification, such as sheet, pipe, tubes, bars and rods. To be free of soldered, brazed, or welded alloyed material; also free of trimmed seams that have been sweated. Soldered, brazed, welded and sweated material, and all painted material shall be packed and sold separately. *Old Nickel Wire, Screen and Cloth* to be packed and sold separately. Samples should be submitted for quotations. *Nickel Castings* to be packed and sold separately, and sold on analysis or sample. *Manganese Nickel* to be sold separately or by sample. *Cupro-Nickel*: Describe the physical characteristics and send representative samples for quotation. *Nickel Turnings* to be sold separately by analysis or according to sample. When submitting a sample of turnings containing oil it must be submitted in oil-proof containers. *Nickel Anodes*: Cast and rolled hard anodes free of soft, carbonised and crusty material. Hooks to be cut off as close as possible to the anode. Substitutions not permitted. *Clean Nickel Peelings and Strippings* and *Copper Nickel Peelings or Strippings* to be sold on sample or analysis. *Nickel Baskets*: Hooks, racks and hangers. Since this material varies to a great extent in alloys and deposits of various metals, representative samples should be submitted for quotation.

New Monel Metal Clips should consist of new Monel clippings, skeleton or plate of the standard grade of Monel. Alloyed Monel to be packed and sold separately. No used or cut old bright sheet Monel will be acceptable. Monel punchings to be sold separately. *Clean Old Monel Sheet* shall be of the standard grade of Monel, free of alloyed Monel. No sweated material of any kind acceptable. Free of welded, brazed or soldered material, other metals and alloy attachments. *Soldered Monel Sheet* to be the whole or a part of a sheet. Free of trimmed seams or sweated trimmed seams. May include Monel welded sheet where a good portion of the piece is attached to the weld. *Soldered Monel Wire, Screen, and Cloth* to be sold separately; must be free of filled filter cloth and asbestos-containing material. *Clean Monel Wire, Screen, and Cloth* must be free of solder; sweated material packed and sold separately. *Monel Turnings* should contain a minimum of 60 per cent. nickel. Should the material contain oil, sample should be submitted in oil-proof container for quotation. *Monel Castings* to be guaranteed minimum 60 per cent. nickel. All other alloys of Monel castings to be packed and sold separately.

Nickel Silver Clips: Sold on nickel content percentage specifications (10-20 per cent.). Leaded nickel silver clips should be packed and sold separately. Description of physical characteristics should be made. Material should also be free of chrome-plated material and any other metal or alloy content material. *Old Nickel Silver*: Sheet, pipe, rod, tubes, wire, or screen, soldered or unsoldered. Must not be trimmed seams alone and is also to be free of foreign substances, iron-rimmed materials, or other metals. *Nickel Silver Castings* to be packed and sold separately. *Nickel Silver Turnings*, to avoid misunderstanding, must be sold by sample or analysis. Samples should be submitted in oil-proof

containers when the sample contains oil. *Ferro-Nickel Chrome Iron*: All castings, forgings, pipe, rod, tubes, wire, screen, ribbon, or any other form, should be sold on analysis basis. Physical description should accompany each sample. Copper content up to 0.5 per cent. to be acceptable. *Ferro-Nickel Iron Alloy*: Alloys containing nickel and iron only. Physical description should accompany each sample and in the case of the larger pieces, approximate weight should be mentioned. Copper content in the alloy up to 0.5 per cent. to be acceptable. Material containing chrome should always be packed separately. *New Stainless Steel,* 18-8 type, graded as new clippings, 0.10 per cent. and under in carbon. *Stainless Steel,* 18-8 type, shall consist of new and old sheet, pipe, rod, tubes, forgings, and flashings. Sold with no carbon guarantee, but to be free of all other metals and alloys. *Stainless Steel Castings*: Submit analysis, size of pieces, and physical description. *Stainless Steel Turnings*: Submit sample.

Silver in Industry*

Some Recent Developments

SEVERAL notable developments have recently taken place which suggest that silver may at last be coming into its own as an industrial metal. A short time ago it was reported from Washington that the Congressional silver bloc had agreed to the use of the Treasury's 100,000 tons of silver for industrial purposes, to replace copper for the duration of the war. Among economies suggested by the British Standards Institution is the use of silver-lead solders, which have been developed for a variety of purposes. Silver-lined bearings are now being used effectively in aircraft engines, and it has been stated that silver is capable of carrying a higher load than babbitt, besides being a better conductor of heat and retaining its hardness at temperatures above those practicable with babbitt.

Valuable Properties

Silver has many valuable properties, some of which are unique. It has the whitest colour of any metal, the highest electrical and thermal conductivity, and the highest optical reflectivity. It is very highly resistant to a wide variety of corrosive agents, and as regards ductility and malleability is second only to gold. It forms salts and compounds with photosensitive and bactericidal properties.

One of its most important properties is the ease with which it can be welded or bonded at only slightly elevated temperatures. This property renders it especially suitable for utilisation in the industrial application of powder metallurgy. Beautiful designs can be obtained in glassware by the application of fine silver powder mixed with borate of lead and lavender oil, the article then being heated until the mixture fuses to the glass. By placing the article in a standard silver cyanide plating bath, any desired thickness of silver can then be plated on to the portion to which the silver paste has been applied. An interesting development is the production of electrical contacts made from powdered silver and such refractory materials as graphite, tantalum, molybdenum, and tungsten.

Chemical Equipment

Pure silver is used to a certain extent as a bonding material in the manufacture of chemical equipment, while alloys consisting of copper with small additions of silver are used for welding copper sheets. Silver solders or brazing alloys in commercial use have a silver content ranging from 5 to 80 per cent., and produce joints of equal or greater strength than those made with base metal alloys. Many silver solders are composed of silver, copper, and zinc, some of the compositions including small proportions of tin, cadmium, nickel, and manganese. Valuable characteristics of these silver brazing alloys are low melting points, malleability and ductility, high strength of joints, corrosion resistance, and electrical conductivity.

In view of the very large potential market for containers such as barrels, drums and cans, the United States National Bureau of Standards has carried out extensive research in silver-plating as a method for economically producing silver-coated sheet. As a result of their experiments they were able to demonstrate the possibility of manufacturing relatively low-cost containers.

Since the first mirror was silvered by Liebig in 1835, many processes have been evolved for producing a thin silver coating on glass, most of them being merely modi-

* From an article in *The South African Mining and Engineering Journal*, January 16, 1943.

fications of the original method. Liebig found that when an aldehyde was mixed with silver oxide and water and then heated, the silver oxide at once became reduced and metallic silver was deposited on the side of the test-tube. The chemical reduction process is still the most widely used in making mirrors, and is also employed in the manufacture of thermos flasks and silvered electric-light bulbs. A more recent development is the vaporisation process, in which a metal or non-metal is distilled from a filament in a vacuum chamber under a reduced pressure. When the vapour pressure of the metal equals or exceeds the pressure of the chamber, molecules of the metal are distilled off and deposited in the form of a thin film. Among the materials which have been effectively silvered by this process are cellophane-type paper and cellulose acetate. Machines have been developed to silver-coat such articles as combs, buttons, or pins on mass-production lines at a very low cost. Compounds of silver are used in the manufacture of luminous materials and intensifying screens for X-rays.

Electrical Uses

Because of its low electrical resistivity and high conductivity silver is extensively used for electrical contacts. In order to reduce the weight or quantity of the silver in actual service, steel-backed silver contacts have been developed, comprising a billet of steel and a billet of fine silver, bonded by a layer of a suitable bonding material such as copper-silver alloy, and fused together. Backings may also be made from other metals, such as copper or nickel. A considerable number of alloys of silver, many of them of patented composition, are used for contacts. Improved transmission characteristics appear to have been provided by the substitution of silver plate for brass in sliding contacts in telephone equipment.

The fact that primary and secondary alcohols may be dehydrogenated to aldehydes and ketones respectively, when passed over heated metals such as copper or silver, has long been known. It has been demonstrated that silver is more effective than copper as a catalyst for the oxidation of alcohols. Platinised silver gauze and silver-platinum alloys have been used for the oxidation of ammonia, while the use of silver, in mixed catalysts, for the oxidation of substances other than alcohols, is frequently referred to in patent literature. One of the largest consumers of silver is the photographic industry, which is fundamentally dependent on the photosensitivity of silver salts.

As a corrosion-resistant material silver has many notable applications. Silver condensers have been successfully employed for the recovery of various corrosive solvents used in the manufacture of acetate rayon. Silver condensing tubes are widely used in the handling of acetic acid. Condensing coils in contact with acetic acid of all strengths have shown no deterioration after fifteen years of service. Vacuum pans, evaporators, condensers, and storage vats made or lined with fine silver have been employed in the production of benzoic acid. Silver equipment has been successfully used for handling essential oils, and has found considerable application in solving the corrosive problems of dyestuff plants. The food industries also use silver in preference to other metals in many applications.

The germicidal properties of silver when brought into contact with germ-containing liquids have long been known, and in modern times silver solutions have been found very effective on certain pathogenic water-borne bacteria. The Katadyn process, which is now in widespread use, provides a comparatively cheap method of dissolving silver in water. It is a valuable means of controlling the growth of slime and algæ, and has been successfully used for military purposes. The Katadyn silver treatment also has a marked action on yeast, lactic acid bacteria, and other micro-organisms.

The effects of small quantities of silver upon the properties and performance in storage batteries, in lead alloys containing from 4 to 12 per cent. of antimony, was recently investigated at Columbia University by A. J. Dornblatt. It was found that about 0.1 per cent. of silver added to the antimony lead inhibits anodic corrosion, lengthens battery life and increases the amount of charge retained on open circuit. Batteries whose grids contain silver are less likely to overheat on overcharge.

Industrial Alloys

Reference has already been made to several of the silver alloys in commercial use. Alloys of silver with over 50 different elements are known, and the development of industrial alloys containing silver presents important possibilities. Not only can silver be strengthened without loss of its essential properties, but in many applications costs can be reduced by the use of suitable alloys in place of the pure metal.

During the past ten years silver production has increased by over 114,000,000 oz. In 1940 the total world output of silver was estimated at 275,736,000 oz. troy, and only the large temporary purchases by the United States Treasury saved prices from collapse. Unfortunately, it is almost impossible to control output, since approximately two-thirds of the world's supply is obtained as a by-product in the treatment of lead, copper, zinc, and gold ores. Since the importance of silver as treasure is diminishing, the future of this metal seems to lie in the development of large-scale industrial uses.

Iron-Carbon Alloys

Presence or Absence of Free Ferrite

THE structural feature consisting of free ferrite in the high-carbon zone of certain carburised steels slowly cooled from the carburising temperature, as observed by McQuaid and Ehn in 1922, is further elucidated by some experiments by T. G. Digges, described in the *Journal of Research* of the National Bureau of Standards. Iron-carbon alloys were prepared from 17 different irons, varying in degree of purity, by oxygen-free carburising in a mixture of hydrogen and benzene vapour, and then cooling from the carburising temperature in this atmosphere at a controlled rate of 2.2° C. per min.

The carburised structure of irons which were free from aluminium, and with a total of less than 0.009 per cent. identifiable impurities, contained free ferrite in the hypereutectoid (carbon in excess of 0.85 per cent.) zone. If oxygen, either dissolved or in the form of oxides, were responsible for this structural feature, then a minute amount (about 0.001 per cent. as determined by vacuum fusion) was sufficient and was as effective as larger amounts. Aluminium in excess of about 0.001 per cent. prevents the formation of free ferrite, and alumina—contrary to the usual belief—was not responsible for its formation in the present alloys. The absence of free ferrite in steels carburised in a hydrogen-benzene atmosphere has been previously attributed to the presence of hydrogen in the carburising atmosphere. However, in the present experiments, the hydrogen dissolved in the irons during the time of carburising had no detectable effect on the amount of free ferrite formed in the final structures.

In the plain carbon steels, the amount of free ferrite in the final structure usually increases with decrease in grain size established at the carburising temperature, that is, a relatively small size of austenitic grain usually implies a relatively large amount of free ferrite in the hypereutectoid zone of the steels cooled slowly from the carburising temperature. In contrast to this, a noteworthy feature of the present high-purity alloys was the relatively large grains containing appreciable amounts of free ferrite. No correlation existed between the austenitic grain size and divorcement of ferrite in these alloys. A summary of these results indicates that a structure containing free ferrite is characteristic of high-purity alloys of iron and carbon of hypereutectoid compositions that have been cooled slowly from the carburising temperature.

Tin Economies

Measuring and Testing the Quality of Tin Coatings

AT the present time, when it is so important that tin should be used as economically as possible, it is very necessary that manufacturers should be able to assess the thickness of the tin coating that they are applying, and this has hitherto presented some difficulties. The full range of methods available is given in the Tin Research Institute's publication No. 115. The methods described come under the following general headings: (a) weighing the component (or test piece) before and after stripping the tin in a chemical solution (Clarke's method: cuprous chloride method; sodium plumbite method); (b) completely dissolving the specimen and determining the tin by analysis (iodine titration method); (c) measuring the time required to dissolve the coating (nitric hydrochloric acid method: dropping test). The publication also contains useful conversion tables showing the weight of tin on various units of area, corresponding to different thicknesses of coating.

The new electro-tinplate, which uses only one-third as much tin as normal tinplate, has so thin a coating on it that the established methods of testing its continuity are inapplicable. The Tin Research Institute's publication No. 116 (reprinted from the J.S.C.I.) describes new tests devised by Dr. R. Kerr. One of these is particularly interesting, as it provides a simple numerical value of the amount of iron exposed to attack over a considerable area, without making a laborious count of rust spots and without the elaborate apparatus required for the hydrogen test. In the first of the new methods, which is suitable either for thick or thin tin coatings, an oxide film is formed on the surface of the tin before applying the hot water test. This prefilming treatment greatly accelerates the test, so that clearly-defined rust spots are developed in 40 minutes. The second method is a modification of the ferricyanide paper test. A paper of suitable texture is soaked in a ferricyanide solution containing a textile penetrating agent, and is then pressed on to the specimen with a roller squeegee. After 10 minutes the pores in the coating appear as blue spots on the paper. The third test determines the quantity of iron dissolved from pores in the tin coating when the specimen is immersed for 15 minutes in an acid thiocyanate solution. This method gives a measure of the quality of the tin coating, and is applicable to any type of tinplate.

Copies of either of the above publications, Nos. 115 and 116, may be obtained free of charge from the Tin Research Institute, Fraser Road, Greenford, Middlesex.

Association of Tar Distillers

Points from the Annual Report

THE year ended December 31, 1942, has seen the increased demand for practically all tar products fully maintained and in most cases extended. The Association kept up the closest contact with the Coal Tar Control and with other Government Departments, trade associations and other bodies having mutual interests.

During the year the Coal-Tar Bituminous Products Sub-committee was appointed to prepare recommendations and technical information on the replacement of asphaltic bitumen by coal-tar products. The sub-committee acted in an advisory capacity on the B.S.I. Panels engaged in the compilation of specifications for coal-tar products which are used in replacement of bitumen. These products should maintain their position on their own merits, but that will depend almost entirely on the industry's supplying first-class preparations and ensuring that they are properly used by consumers. The National Transport Committee was also constituted on the basis of regional representations to secure co-operation of the regions on transport problems.

Several Control Orders, issued in revised form during the year, gave rise, prior to their appearance, to the formation of committees of members of the industry by the Coal Tar Control, and in this way the Controller was in a position to formulate the Orders in the knowledge of the industry's position in relation to his proposals.

The regional committee continued to intensify the regional co-operation which started with planning for mutual help in the event of enemy attack, especially air attack, but which in the relative absence of such disturbance developed during the year in every direction where regional activities assisted the regional or the national efforts of the industry.

Tar Products

In the early part of the year, after extended discussions, a contract and memorandum of procedure for the supply of tar fuel oil to the Petroleum Board was agreed. The extended use of pitch directly as fuel in certain directions has continued to engage the attention of the industry, but Association activity in the use of pitch has been directed more intensively to its replacement of asphaltic bitumen in a number of directions. The work of the Coal Tar Bituminous Products Sub-committee has opened up many new uses in connection with constructional work. Properly developed in actual production and treated as carrying a considerable measure of responsbility on tar distillers to produce satisfactory material and ensure the proper servicing of the market, this new field offers opportunities of a first class and permanent nature.

The extraction of tar acids and the production of phenol and other refined fractions thereof was developed very considerably during the year, in response to the pressing demand for finding material of first importance to the plastics and other war industries. The export of cresylic acid, notably the U.S.A. requirements, constituted a problem of increasing importance during the latter part of the year and steps were taken to examine the possibilities of a joint scheme with the merchant exporters for the proper co-ordination of the business, should such a system be necessary. The Toluene Sub-committee, strengthened by additional representation of coke-oven interests, again investigated the costs of production of nitration toluene and 90's toluol.

Standardisation

The Association's interest in the activities of the B.S.I. have centred round the preparation of specifications for tar products used in substitution for asphaltic bituminous products. Specifications for pitch mastics for flooring and damp courses, and for black paint (tar base) for use on iron and steel, were issued during the year. The B.S.I. activities for the utmost economy in the use of containers (and, so far as the tar distilling industry is concerned, metal containers in particular) have been watched, and members have been given opportunities for guiding their representatives on the B.S.I. committees dealing with this work.

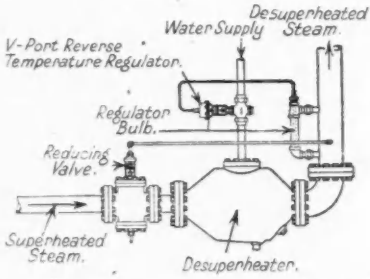
Extensive consideration has been given to the question of the general level of prices of coal-tar products in relation to the increased costs bearing on the industry as a whole. Those deliberations necessarily had first regard to the Controllers' price structure. The Executive Committee elected a small sub-committee to investigate and report on the possibilities of establishing a basis on which proper prices for tar products could be automatically determined from changes in the principal cost factors.

Officers for the Year

At the annual general meeting on March 17, the officers and the executive committee for the ensuing year were elected. All the officers for the previous year (*see* THE CHEMICAL AGE, May 2, 1942) were re-elected for another term, and the executive committee likewise remained the same, except that Mr. J. A. Hebden (South Yorkshire Chemical Works, Ltd.) replaced Mr. C. F. Ward Jones in the N. Midlands region.

A SIMPLE DESUPERHEATER

The accompanying sketch illustrates a simple dependable desuperheater described in *Chemical Industries*, 1942, 51, 7. It is made up mostly of standard pipe fittings and a high grade temperature regulator and reducing valve. As the sketch shows, the



superheated steam first passes through a reducing valve which automatically regulates the pressure of the desuperheated steam. A temperature regulator bulb is placed within a sampling by-pass pipe connection as shown, the later being made up entirely of ordinary pipe and pipe fittings. The regulator bulb causes a V-port reverse temperature regulator to admit the proper amount of water into the desuperheater chamber. In this way the desired temperature and pressure are both attained and mainained for the desired service.

NEW AMERICAN SERVICE

A service which aims at solving a problem facing American industries—the problem of which substiutes to use and where to find them, now that the country is faced with increasing shortages of materials—is announced by the Berliner Technical Research organisation, of 22 Fifth Avenue, New York. The service offers information on substitutes for items on the critical list and gives the available sources, this information being issued to subscribers in a system of continuous monthly supplementary reports. Those seeking highly specialised information not in the regular service are offered individual consulting privileges, without charge. Materials for which substitutes are offered are cellulose, paper, fats, oils, waxes, soaps, foods, leathers, glue, metallurgical and mineral materials, packing materials, fuels, ceramics, petroleum, lubricants, asphalts, pharmaceuticals, cosmetics, perfumes, pigments, paints, varnishes, lacquers, rubber, plastics and allied products, sugar, starch, gums, textiles, and waste products.

Edible Oil Offences

Fines Total £14,500

TRANSACTIONS in edible oils used in making synthetic cream led to the imposition of fines totalling £14,595 by the Recorder (Sir Gerald Dodson) at the Old Bailey recently. The Times Food Products Co., Ltd., were fined £10,750 for selling to a trade user ground-nut oil and palm-kernel oil otherwise than in accordance with a Food Ministry permit and for selling wholesale otherwise than in accordance with the terms of a licence granted by the Food Ministry. Quality Foods, Ltd., were fined £2850 for buying the ground-nut oil, engaging in the manufacture of synthetic cream otherwise than by licence, and furnishing false information for the purpose of the Food Substitutes Control Order, 1941. Benjamin Rood was fined £300 and ordered to contribute £25 towards the cost of the prosecution for selling by wholesale 263¾ cwt. of palm-kernel oil. Douglas Edwards, who was stated to hold one share only in the Times Food Products Company, was fined £200. Hans Kirstein Ciconi Albak, who was said to have introduced the manufacture of synthetic cream into England, was fined £475 and ordered to pay £75 towards the cost of the prosecution, and James Albert Keeping was fined £20 for making a false statement in furnishing information.

SHEEP AND CATTLE DIP MANUFACTURERS

At an inaugural meeting last month, the Association of British Sheep and Cattle Dip Manufacturers was formally constituted. Its object is to further the welfare of the British sheep and cattle dip industry, and the precise nature of its activities will be determined by that over-riding object. The officers of the Association are: *Chairman*, Mr. W. E. O. Walker-Leigh (Cooper McDougall & Robertson, Ltd.); *Vice-Chairman*, Mr. H. A. Smith (Lawes Chemical Co., Ltd.); *Treasurer*, Mr. V. G. Gibbs (Wm. Pearson, Ltd.); *Auditor*, Mr. R. J. H. Hope (Standardised Disinfectants Co., Ltd.); *Secretary*, Mr. W. A. Williams, B.Sc. The offices of the Association are at 166 Piccadilly, London, W.1.

The tremendous increase in the demand for acetylene in the U.S. has created a shortage of that gas, with the result that the use of propane for metal cutting has greatly increased during the past year. More shipyards and other fabricators of steel sheets and plates are reported to be using propane for cutting and saving acetylene exclusively for welding.

General News

From Week to Week

Civil estimates for the year ending March 31, 1944, issued last Saturday, include an increase of £82,985 allocated to the Department of Scientific and Industrial Research.

The sum of five guineas was raised for the Red Cross Penny-a-Week Fund by a special collection in the drawing office of a Tyneside shipbuilding firm in memory of a former colleague who died recently in an Italian prison camp.

The D.F.C. has been awarded to four R.A.F. flyers who took Mosquito light bombers to Norway on March 3 and bombed the buildings of the molybdenum plant at Knabon, near Kristiansand, Germany's only source of molybdenum.

Experiments on the theory that sea fish can be multiplied by the addition of nitrogen and phosphates to the sea-plant food are being carried out in Scotland. Last year the size of flounders was multiplied ten times, according to the Secretary of State for Scotland.

The idea of a "Technical House" capable of accommodating all the technical bodies in Birmingham—engineering, mechanical, electrical, motor, chemical, metallurgical, plastics, transport, etc.—was advocated last week at the annual meeting of the Midland Section of the Institute of Chemistry in Birmingham.

A sub-committee of the Post-War Planning Committee of the British Gas Federation has been appointed to prepare the ground for reorganisation of the industry. The electricity industry is also preparing a scheme for submission to the Minister of Fuel and Power, who has stressed the need for co-operation between the two industries.

The amount of crude rubber, reclaimed rubber, and zinc oxide that may be used in the vulcanised compound for soles and heels is subject to limits, and for many types of sole and heel the use of crude rubber is forbidden by the Control of Rubber (No. 19) Order (S.R. and O. 1943, No. 478). The Order, which came into force on April 1, also fixes the maximum volume for heels and the types of sheeting which may be manufactured.

The Winter/Spring issue of *Smokeless Air*, the journal of the Smoke Abatement Society, contains much interesting information, including a list of over eighty Local Authorities who have passed resolutions supporting the society's proposals for the prevention of smoke in post-war building, and an article by an economist showing how the provision of plant and equipment for the complete smokelessness of Britain could be made part of schemes for the maintenance of full employment in the future.

Reference was made at a "budget" meeting of the St. Austell Rural Council last week, to the effect on the rates of the position in the china-clay industry. Mr. F. Dempster pointed out that about one-third of the total rateable value of the district depended on the china-clay industry, which had further declined during the past year. The rateable value of china-clay hereditaments, etc., showed a reduction, in the current triennial period, of approximately 56 per cent.

Following his generous gift to Leeds University, Mr. Henry Ellison, of Calverley, has presented £25,000 to the University of Sheffield for the promotion of scientific research. The gift consists of an annual sum of one-seventh of £25,000, spread over the coming seven years. Mr. Ellison, who is a director of Yorkshire Tar Distillers, the Sheffield Chemical Company, and other firms, has suggested that the council should expend the money during the early years of peace on a scientific research fellowship.

A combined copper committee, to work in Washington, has been created on behalf of the United Kingdom, the United States, and Canada. Its members are: Harry O. King, Jr., chairman; R. R. Nathan, Combined Production and Resources Board; Lincoln Gordon, Combined Raw Materials Board; A. McDougall, Combined Raw Materials Board; M. I. Michaels, British Ministry of Supply Mission; George McDonald, representing the Metal Comptroller, Canada; Lt.-Col. James Boyd, U.S. Army; Lt.-Com. Paul F. Linz, U.S. Navy.

Messrs. Ashworth & Parker, Ltd., Bury, Lancs., announce that Messrs. Walmsleys (Bury), Ltd., paper-makers' engineers, have taken a controlling interest in the business as from March 1. Mr. F. O. L. Chorlton and Mr. W. S. Parker have retired from the board of directors and Mr. John Wolstenholme, as chairman, and Mr. R. P. Timpany, have been appointed to the board. Mr. E. S. Hardman, chief engineer, and Mr. H. Sheldon, commercial manager and secretary, retain their seats on the board and will be responsible for the management. The firm will continue as a separate concern and concentrate as heretofore on the manufacture of high-speed steam engines, etc.

Foreign News

The greater part of the stipulated quantity of copper sulphate, negotiations for which had been carried on with Britain, has now arrived in Portugal.

Uganda is now growing cinchona bark for vital quinine supplies in suitable parts of the Protectorate. Further cultivation by the native administration is under consideration.

The Argentine Government is proposing to spend 24 million pesos in the construction and equipment of a plant to produce power alcohol from cereals and potatoes.

The import of shellac into Canada is prohibited except by permission of the Minister of National Revenue, in accordance with an Order in Council (P.C. 1421), dated February 22.

Nylon for printing type is forecast in U.S.P. 2,282,448. The patent claims that the impressions are clear and sharp, and that the material may be recast as required when worn out.

Among a group of Russian scientists who have been awarded the Stalin Medal for Science, the best known in this country is Professor Peter Kapitza, who worked with Lord Rutherford for 12 years at the Cavendish Laboratory, Cambridge.

Tests by American experts have discovered numerous potential oilfields on the Arabian coasts of the Persian Gulf and the Red Sea, according to the Independent French News Agency. It is suggested that Arabia may one day rival Iraq in oil production.

Output of liquefied petroleum gases at American oil refineries increased from 10,000,000 gallons in January, 1942, to more than 20,000,000 gallons per month in midsummer, and the figure is reported to be still rising.

Galvanising operations in the U.S.A. have been greatly reduced in order that the zinc used for the purpose may be diverted to more essential production. Galvanised sheets, however, will still be produced in sufficient quantity to cover all war and essential civilian needs.

It is stated that during his stay in Santiago, Mr. Wallace, vice president of the United States, is trying to reach an agreement whereby water-power schemes in Chile might help in increasing exports to the Allies to fulfil the vital war needs of nitrates and copper.

Production of petroleum in the Bahia oilfields (Brazil) has considerably increased, and it is expected that, with the installation of new equipment received from the U.S.A., the annual production of the State's oil wells will be raised to 36,500,000 litres. It is reported that large quantities of natural gas also exist in the same region.

Because available supplies of ferrochrome are limited, an order requiring the increased use of scrap and chrome ore in the production of stainless steel has been issued by the U.S. Director General for Operations. This action has been taken because most of the steel companies have been unnecessarily wasteful in their consumption of ferrochrome and have not taken full advantage of available scrap.

The N'Changa Mines, the largest and richest in the Northern Rhodesia copper belt, are reported to be on the eve of reopening. The development of these mines has been delayed because a large proportion of the copper reserve consists of oxide ore, which is more difficult to treat than sulphide ore. Total reserves are reckoned at 144,000,000 tons of ore, with an average of 4.66 per cent. of pure copper.

The Manufacturing Chemists' Association of the United States has filed a formal protest against the adoption of a Bill proposing to establish an "Office of Technical Mobilisation." It is claimed that the Bill, which gives the Government power to investigate closely the activities of all trained scientific personnel and to compel the licensing of all patents, etc., would be simply regimenting research. The association contends that it would curtail rather than promote scientific effort.

Lead and zinc pigments and zinc salts sold by manufacturers in the United States were down sharply in 1942 from their high rates in 1941, according to the U.S. Bureau of Mines. Lead pigment production decreased by about 23 per cent., and zinc pigments were 26 per cent. down, while zinc sulphate also decreased, and 50,000 tons of zinc chloride (50° Bé.) were produced, compared with 63,786 tons in 1941. The competitive titanium pigments fared about the same as the lead class, although restrictions in the use of titanium pigments were lifted soon after being imposed.

Forthcoming Events

The **Electrodepositors' Technical Society,** London section, will meet in the Northampton Polytechnic, London, E.C.1, at 5.30 p.m., on **April 5,** when Mr. C. J. Leadbeater will open a discussion on "Devices for Controlling the Distribution of Electro-deposits."

The fourth and last in the series of lectures on the Modern Power Station will be given before the **Royal Society of Arts,** at 1.45 p.m., on **April 5.** The speaker, Mr. C. W. Marshall, will take as his subject "High Voltage Power Circuit Control."

Mr. A. H. Bennett will give an address on "The Sicilian Chemical Industry" before the London section of the **Society of Chemical Industry** at 2.30 p.m., on **April 5.** The meeting will be held in the Chemical Society's rooms, Burlington House.

The last of Sir Lawrence Bragg's four lectures to the **Royal Institution** on the Solid State will take place at 3 p.m., on **April 6.** The title will be "Present Day Developments."

The Birmingham section of the **Electrodepositors' Technical Society** will meet at the James Watt Memorial Institute, Great

Charles Street, Birmingham, at 6 p.m., on **April 6,** when a paper on " Applications of Heavy Nickel Deposition " will be presented by Mr. L. Wright.

The **Institute of Fuel** will meet in the Geological Society's rooms, Burlington House, at 5.30 p.m., on **April 8,** when Mr. F. McNeill will present a paper on " The Purchase of Coal by Industrial Users," to be followed by a discussion.

Readers are reminded that the second conference on X-Ray Analysis in Industry, organised by the **Institute of Physics,** as announced in our columns on February 20, will take place in Cambridge on **April 9** and **10,** opening at 2.15 p.m. on the first day, and ending at 4.30 on the second.

The annual general meeting of the **Society of Glass Technology,** to be held at " Elmfield," Northumberland Road, Sheffield, will be followed by a conference on " Youth and Technical Education." This will be opened by Mr. George Chester, of the General Council of the T.U.C., on the afternoon of **April 13.** The conference will continue throughout the following day, and contributors will include gentlemen eminent in the glass industry and in education.

The Trueman Wood lecture of the **Royal Society of Arts** will be given by Mr. J. G. Crowther, at 1.45 p.m., on **April 14.** The subject will be " Science in Soviet Russia."

A meeting of the Road and Building Materials Group of the **Society of Chemical Industry** will be held in Gas Industry House, Grosvenor Place, on **April 14,** at 5 p.m., when Mr. R. C. Bevan will present a paper on " Experience of the Behaviour of Building Materials in Fires."

The ninth Liversidge lecture of the **Chemical Society,** entitled " Magnetochemistry " will be given by Professor S. Sugden, in Burlington House, at 2.30 p.m., on **April 15.**

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Winding-Up Petition

METAL ABRASIVES, Ltd. (W.U.P., 3/4/43.) A petition for winding up has been presented by Cattermoles (Transport), Ltd., 79-80 Pentonville Road, London, N.1, and was heard at the Royal Courts of Justice, Strand, London, on March 29.

Company News

General Refractories, Ltd., announce a dividend for 1942 of 7 per cent. (5 per cent.), and a trading profit for the company and its United Kingdom subsidiaries of £247,174 (£185,115.)

British Xylonite, Ltd., announce a net profit of £28,296 (£27,183), and, as already stated, a final dividend of 7½ per cent., making 10 per cent. (same.)

New Companies Registered

Synthalloy, Ltd. (379,503).—Private company. Capital: £5000 in 5000 shares of £1 each. Manufacturers of and dealers in synthetic materials, metals and alloys, plastics, chemical, scientific, and industrial plant, etc. Subscribers: T. H. O. Davis, I. G. Davies. Registered office: 41 Westgate Street, Cardiff.

Falcon Oil Company, Ltd. (379,513).—Private company. Capital: £15,000 in 15,000 shares of £1 each. Manufacturers, refiners, and producers of and dealers in oils, lubricants, grease, tallow, petrol, tar, bitumen, oil fuels, etc. Directors: E. Cunnah, R. Macdonald. Registered office: Praed Road, Trafford Park, Manchester.

Clino-Vac Laboratories, Ltd. (379,414).—Private company. Capital: £500 in 500 shares of £1 each. To acquire the business of a bacteriological, chemical and clinical laboratory carried on by W. Rowe, at 28 Lancaster Terrace, London. Directors: W. Rowe, W. N. Rowe and C. S. Townsend. Registered office: 24 Uxbridge Road, W.5.

Agstone, Ltd. (379,547).—Private company. Capital: £2000 in £1 shares. Manufacturers of and dealers in lime, fertilisers, chemicals, disinfectants, dyes, agricultural requisites, etc. First directors: C. A. E. C. Howard, R. F. Marshall, W. J. Hay and A. H. Bennett. Registered office: Limestone Quarry, Medbourne, near Market Harborough, Leicester.

Multimek, Ltd. (379,451).—Private company. Capital: £1075 in 1000 6 per cent. cumulative preference shares of £1 each and 1500 ordinary shares of 1s. each. Designers and manufacturers of, dealers in, and agents for mechanical, electrical, chemical, combustion and other engines, air-conditioning and dust-extracting plant, furnace and blast-furnace equipment, industrial appliances, etc. Directors: V. Dibovsky, N. R. Reynolds, A. S. Poynton, W. M. C. Brookes. Registered office: 47/8 Piccadilly, W.1.

Chemical and Allied Stocks and Shares

SENTIMENT in the industrial and other sections of the Stock Exchange responded to the war news from Tunisia, and security values tended to improve, although little expansion of demand was in evidence. Among shares of chemical and kindred companies, firmness was maintained in Imperial Chemical, which improved further to 39s. 3d., awaiting the dividend statement; the 7 per cent. preference units were higher

at 35s. 9d. Aided by the improved dividend, General Refractories 10s. shares at 15s. 10½d. have continued to hold all but a small part of their recent rise. Borax Consolidated at 54s. 6d. were firm, and at 35s. 9d. Lever & Unilever were well maintained on balance. British Aluminium showed firmness at 49s. 3d. on consideration of the full report for the past year's working. In other directions, Imperial Smelting strengthened to 13s. 6d.

British Match were inclined to improve, having changed hands around 38s. 4½d., while Dunlop Rubber responded to the better tendency on the Stock Exchange and were quoted at 35s. Moreover, Nairn & Greenwich rose further from 65s. to 66s. 3d., and Barry & Staines from 41s. to 42s., while at 37s. 3d. Wall Paper Manufacturers deferred units were well maintained. Turner & Newall at 74s. 9d. were a few pence lower, but remained firmly held, despite the moderate yield shown on the basis of last year's 12½ per cent. dividend. This is one of the many instances where a leading industrial share is influenced mainly by the strength of the balance-sheet and by the view that after the war dividend rates may return to around the levels ruling prior to 1940. In other directions, B. Laporte continued firm at 78s., awaiting the financial results due in May. Greeff-Chemicals 5s. units changed hands up to close on 8s., while Monsanto Chemicals 5½ per cent. preference were again 22s. 6d. Results of the last-named company are due shortly.

Fisons were quoted at 44s., and W. J. Bush were again 50s. "middle." Burt Boulton changed hands at close on 20s., while in other directions, British Drug Houses remained at 22s. 6d. Beechams Pills deferred moved up to 15s. 4½d., awaiting the dividend announcement. Among shares of companies with interests in plastics, British Industrial Plastics 2s. ordinary remained at 5s. 10½d., Lacrinoid Products 4s. 7½d., and Erinoid were 11s. 6d. At 19s. 6d. and 48s. 9d. respectively, British Celanese and Courtaulds more than maintained recent gains. Bradford Dyers further improved from 16s. to 16s. 9d. Now that all arrears of this company's preference dividend are being paid, the market remains hopeful that results for the current year may permit resumption of dividends on the ordinary units. It is recognised, however, that it must be expected that a good proportion of future profits will be used in building up reserve funds. Associated Cement had an easier appearance at 59s. 6d. pending the dividend announcement, but elsewhere British Plaster Board maintained their recent improvement to 28s. Stewarts & Lloyds were again steady at 54s. 3d., awaiting declaration of the interim dividend. Tube Investments at 93s. 6d. were within 3d. of the level ruling a week ago, and Babcock & Wilcox were higher at 50s. 9d. There was again an upward tendency in shares of paint manufacturers; Lewis Berger transferred up to 84s. 9d.; Pinchin Johnson 10s. ordinary were better at 32s. 9d. on market hopes of improvement in the forthcoming dividend. Anglo-Iranian and other leading oil shares were higher under the influence of the war news.

British Chemical Prices

Market Reports

NEW bookings in heavy chemicals during the past week have been on a moderate scale and supplies against contracts are being taken up at a steady rate. Strong price conditions are reported from most sections of the market and while no active price changes have taken place the tendency is undoubtedly towards higher levels. Among the soda compounds caustic soda is attracting fair attention and good quantities are being absorbed. Steady trading conditions are reported in Glauber salt, salt cake and bicarbonate of soda. Nitrate of soda and acetate of soda are firm and the hyposulphites of soda are a good market. The scarcity of supplies is the chief feature of the potash section, with yellow prussiate of potash more or less nominal. The demand for the B.P. and technical grades of permanganate of potash continues satisfactorily and home producers of the material are well booked. Supplies of caustic potash are being steadily absorbed by priority consumers and acid phosphate of potash is in good request. In the market for coal-tar products creosote oil is an active item while crude tar and pitch are receiving a fair inquiry. A brisk demand is reported for the xylols, benzols, and toluols.

MANCHESTER.—The textile and allied trades in Lancashire and Yorkshire are taking fair quantities of chemical products against existing commitments, and a continued good contract demand from other industrial users has also been reported on the Manchester market during the past week, though new buying has been no more than moderate. Among the acids, trade in sulphuric and hydrochloric has been maintained, while a steady demand has been experienced for caustic and other soda compounds. All potash chemicals are being absorbed as parcels become available. The tar products are all on a firm price basis, and a steady demand is reported for crude tar, creosote oil, cresylic and carbolic acids, and the general run of light materials.

GLASGOW.—In the Scottish heavy chemical trade there is no actual change in the position from last week. Home business remains steady. Export trade is still rather restricted. Prices continue very firm.

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TWELVE 400-ton Cake Presses, W.P. 2 tons, Tables 36 in. by 18 in., suitable for conversion for moulding. THOMPSON & SON (MILLWALL), LTD., Cuba Street, Millwall, London, E.14. East 1844.

MISCELLANEOUS MACHINERY FOR SALE.

ONE—Second-hand DEGREASING TANK, 10 ft. 0 in. dia. by 13 ft. 6 in. high, with dished ends, fitted with three 16-in. manholes with loose covers secured by wing nuts; one 9¾-in. pad on top; two 24-in. manholes with screwed pressure covers on side; one 4-in. pal and four outlets ¾ in. to 3 in. on bottom; seven outlets on side near bottom; ⅝-in. mild-steel plate, single and double riveted, fitted with 2 in. steam coil in bottom approx. 200 ft.; capacity 6,500 galls.

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RUBBER Mixer or "internal mixer," W.P. type, water-cooled rotors and jacket; 20 in. by 20 in. by 24 in.; massive design; rotors driven 3¾ in. face gears either end; packed force lubricated glands; two loose and one fast pulley 27 in. by 5 in. Excellent condition. Price £250. Can be inspected London. Box No. 2110, THE CHEMICAL AGE, 154 Fleet Street, London, E.C.4.

AGENCIES

TO agents, etc.—Liberal commission for introductions to clients requiring acid pickling and storage tanks, acid-resisting floors, etc. Write Box No. 2109, THE CHEMICAL AGE, 154 Fleet Street, London, E.C.4.

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GRINDING of every description of chemical and other materials for the trade with improved mills.—THOS. HILL-JONES, LTD., "Invicta" Mills, Bow Common Lane, London, E. Telegrams: "Hill-Jones, Bochurch, London." Telephone: 3285 East.

PATENTS & TRADE MARKS

KING'S PATENT AGENCY, LTD. (B. T. King. A.I.Mech.E., Patent Agent), 146a Queen Victoria Street, London, E.C.4. ADVICE Handbook, and Consultation free. 'Phone: City 6161.

WORKING NOTICES

THE Proprietor of Patent No. 504543 for "Improvements in or relating to hard metal alloys" is desirous of negotiating with interested parties with a view to promoting the full commercial development of this invention in the United Kingdom by way of the grant of licences or otherwise on reasonable terms. Please address communications to Blackburn & Pollett, 12 Vernon Walk, Tadworth, Surrey.

Printed in Great Britain by THE PRESS AT COOMBELANDS, LTD., London and Addlestone, and published by BENN BROTHERS, LTD., at Bouverie House, 154, Fleet Street, E.C.4., April 3rd, 1943. Entered as Second Class Matter at the New York, U.S.A., Post Office.